My contribution to science is reflected in 58 full size peer-reviewed research papers, 10 reviews, and more than 100 presentations at international meetings. It is also imprinted in a dozen of postdoctoral trainees and graduate students and two dozen undergraduates who have successfully worked in my laboratory.

PubMed search for "Beloozerova" http://www.ncbi.nlm.nih.gov/pubmed/?term=Beloozerova misses only a few of my original research reports related to my work in the Soviet Space Program and 5 early reviews/book chapters, while including only 1 publication that does not belong to me (the oldest one).

1. My career in neuroscience started in the Institute of Problems of Information Transmission in Moscow, USSR, where, under supervision of Drs. Grigori Orlovsky and Yuri Arshavsky, I contributed to studies of cellular mechanisms of behavior in mollusks. The major accomplishment of this work during my time in the laboratory **(1980–83)** was the description of cellular mechanism of the swimming generator in the marine mollusk *Clione limacina***.** This was one of the first networks, which functioning was thoroughly described in an invertebrate, and I was the first person to note identifiable neurons in *Clione*, a species other than *Aplisia.* This work is reflected in my 8 full size peer-reviewed original publications, most important of which are:

a. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. I. Efferent activity during actual and fictitious swimming. *Exp. Brain Res.*, 58(2): 255-262, 1985.

b. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. II. Rhythmic neurons of pedal ganglia. *Exp. Brain Res.*, 58(2): 263-272, 1985.

c. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. III. On the origin of locomotory rhythm. *Exp. Brain Res.*, 58(2): 273-284, 1985.

d. Arshavsky YuI, Beloozerova IN, Orlovsky GN, Panchin YuV, Pavlova GA. Control of locomotion in marine mollusc Clione limacina. IV. Role of type 12 interneurons. *Exp Brain Res*, 58(2):285-293, 1985.

2. During my following tenure at the Institute of Biomedical Problems, Moscow, USSR **(1981–93),** I have participated in the Soviet Space Program that was carried out aboard bio-satellites "Cosmos". My major accomplishments were:

- First, to ensure that single unit recordings of high quality are obtained from head-unrestrained Rhesus monkeys over periods of months, including a space flight, I, in collaboration with Dr. Mikhail Sirota, have developed an original method for extracellular recording of neuronal activity in freely moving animals (monkeys and cats) that is still in use in my and several other laboratories in the USA.
- In studies on the effects of weightlessness on gaze fixation reactions in Rhesus monkeys, I, as a member of Dr. Kozlovskaya's group, contributed to showing that: 1) The excitability of the vestibular system observed in kinematics and dynamic parameters of eye and head movements increases dramatically during the first week of space flight, 2) The dynamic responses of neurons in Nucleus vestibularis lateralis and in floccular zone of the cerebellum during gaze fixation and during lifting reaction increase in the first week of space flight, and 3) All adaptive changes in eye-head coordination and associated neuronal activity are completed within two weeks of space flight.

This work is reflected in following original research reports published in English:

a. Sirota MG, Babaev BM, Beloozerova IN, Nyrova AN, Kozlovskaya IB. Characteristic of vestibular reactions to canal and otolith stimulation at an early stage of exposure to microgravity. *Physiologist*, 30 (1 Suppl.): S82-84, 1987.

b. Kozlovskaya IB, Babaev BM, Barmin BA, Beloozerova IN, Kreidich YuV, Sirota MG. The effect of weightlessness on motor and vestibulo-motor reactions. *Physiologist*, 27(6): 111-114, 1984.

c. Sirota MG, Babaev BM, Beloozerova IN, Nyrova AN, Yakushin SB, Kozlovskaya IB. Neuronal activity of Nucleus vestibularis during coordinated movement of eyes and head in microgravitation. *Physiologist*, 31 (1 Suppl.): S8-9, 1988.

d. Kozlovskaya IB, Ilyin EA, Sirota MG, Korolkov VI, Babayev BM, Beloozerova IN, Yakushin SB. Studies of space adaptation syndrome in experiments on primates performed on board of soviet biosatellite "Cosmos-1887". *Physiologist*, 32 (1 Suppl.): S45-48, 1989.

e. Correia MJ, Perachio AA, Dickman JD, Kozlovskaya IB, Sirota MG, Yakushin SB, Beloozerova IN. Changes in monkey horizontal semicircular canal afferent responses after spaceflight. *J. Appl. Physiol.,* 73 (2 Suppl.): 112S-120S, 1992.

3. In addition, at a time when it was unclear whether the motor cortex participates in control of locomotion, the most essential and frequently used behavior of all animals (**early and mid-80s**), I, working in freely walking cats, have showed that it does, and that this control concerns not with the vigor of the movements but their spatial organization - the movement's accuracy. The work to reveal specifics of the control has continued more recently at the Barrow Neurological Institute in Phoenix, Arizona (**2000 - present)**, and results are reflected in about a dozen full size peer-reviewed original research reports overall, most important of which are:

a. Beloozerova IN, Sirota MG. The role of the motor cortex in the control of accuracy of locomotor movements in the cat. *J. Physiol. (L.)*, 461: 1-25, 1993.

b. Beloozerova IN, Sirota MG. The role of the motor cortex in the control of vigour of locomotor movements in the cat. *J. Physiol. (L.)*, 461: 27-46, 1993.

c. Beloozerova IN, Farrell BJ, Sirota MG, Prilutsky BI. Differences in movement mechanics, electromyographic, and motor cortex activity between accurate and non-accurate stepping. *J. Neurophysiol.*, 103: 2285-2300, 2010.

d. Stout EE, Beloozerova IN. Differential responses of fast and slow conducting pyramidal tract neurons to changes in accuracy demands during locomotion. *J. Physiol (L.)*, 591(Pt 10): 2647-66, 2013.

e. Stout EE, Sirota MG, Beloozerova IN. Known and unexpected constraints evoke different kinematic, muscle, and motor cortical neuron responses during locomotion. *Eur. J. Neurosci.* 42(9): 2666-77, 2015.

4. During 17 years at the Barrow Neurological Institute I've lead several interesting studies:

- On how the thalamus and cortex act and interact for control of locomotion on complex terrains. In these studies, we have revealed physiological "faces" of several morphological classes of neurons in the thalamo-cortical network. We were the first to characterize the activity of the reticular nucleus of the thalamus during any motor behavior, and to suggest the distinct roles of its shoulder- and wrist-related neuronal subpopulations in shaping locomotion-related discharges of neurons in the ventro-lateral thalamus, including those projecting to motor cortex (*J. Neurosci.*, 32(45):15823-36, 2012; *J. Neurophysiol.,* 112(1): 181-192, 2014). We then showed that neurons from layer 6 of the motor cortex that project solely to the thalamus are only sparsely active during locomotion, but their spikes are bundled into short bursts that are precisely timed to specific phases of the stride (*J. Neurosci.*, 25(25): 5915-5925, 2005). Recently we found that the activity of neurons in high subdivisions of primary somatosensory cortex (areas 1 and 2) during locomotion often represents the somatosensory events in a predictive fashion, that is, before they actually take place (*J. Neurosci.*, 35(20): 7763-76, 2015).

- **On how vision controls locomotion.** We have developed a novel technique to very accurately record gaze in freely walking cats, and found that during walking the gaze moves along surface in a step-like manner (*Neuroscience*, 275: 477-499, 2014; *cover paper*). Researching the activity of cortical parietal area 5, we have found four modes, by which this area integrates visual signals about heterogeneity of the surface with signals about the activity of basic locomotor mechanisms (*J. Neurophysiol.*, 90(2): 961-971, 2003). We then found that the ventro-lateral thalamus is not a simple cerebellum-to-cortex relay, but that it integrates and transmits to motor cortex visual information needed for correct feet placement on a complex terrain (*J. Neurophysiol.,* 107(1): 455-472, 2012). We ultimately found that the activity of neurons in motor cortex depends on whether the cat sees and uses vision during walking or not (*Behav. Brain Res.*, 250: 238-250, 2013; plus a paper currently in revision).

There were other exciting studies and findings as well, and results are presented in about two dozen full size peer-reviewed original publications. It is difficult for me to pick one, but probably my most important accomplishment in the field of locomotion research during my tenure at the Barrow Institute is a demonstration of **the distinct nervous controls for shoulder, elbow, and wrist** during locomotion. We first characterized neurons in the thalamo-cortical network in respect to location of their somatosensory receptive field, analyzed their activities during locomotion, and found that the shoulder-, elbow-, and wrist-related subpopulations are active differently:

a. Stout EE, Beloozerova IN. Pyramidal tract neurons receptive to different forelimb joints act differently during locomotion. *J. Neurophysiol.*, 107(7): 1890-1903, 2012.

b. Marlinski V, Nilaweera WU, Zelenin PV, Sirota MG, Beloozerova IN. Signals from the ventrolateral thalamus to the motor cortex during locomotion. *J. Neurophysiol.*, 107(1): 455-472, 2012.

c. Marlinski V, Sirota MG, Beloozerova IN. Differential gating of thalamo-cortical signals by reticular nucleus of thalamus during locomotion. *J. Neurosci.,* 32(45): 15823-36, 2012.

d. Marlinski V, Beloozerova IN. Burst firing of neurons in the thalamic reticular nucleus during locomotion. *J. Neurophysiol.*, 112(1): 181-192, 2014.

- We **have reviewed** the initial part of neuronal activity data four years ago in: Beloozerova IN, Stout EE, Sirota MG. Distinct thalamo-cortical controls for shoulder, elbow, and wrist during locomotion. *Front. Comput. Neurosci.*, 7:62, 2013.

We then moved forward to research inter-segmental dynamics of the forelimb and found that while during locomotion the shoulder rotates primarily by muscle torque, elbow and wrist rotations are produced chiefly by passive torques and only fine-regulated by muscle torque (a paper is in revision). These findings explain differential activities of corresponding neuronal subpopulations throughout the thalamo-cortical network, and provide the basis for hypotheses regarding functional effects of these activities during locomotion.

5. In addition, during my tenure at the Barrow Neurological Institute, our laboratory has pioneered research on cortical neuronal mechanisms of posture and balance. These studies were conducted in collaboration with Drs. Deliagina, Zelenin and Orlovsky from Karolinska Institute in Stockholm, Sweden, or with Dr. Prilutsky from Georgia Institute of Technology in Atlanta, GA. We have directly demonstrated that the motor cortex closely participates in maintenance of a task-specific posture and balance and have characterized the roles of several efferent sub-populations of motor cortex in maintenance of posture and balance. Results are presented in 13 full size original publications, most important of which are:

a. Beloozerova IN, Sirota MG, Swadlow HA, Orlovsky GN, Popova LB, Deliagina TG. Activity of different classes of neurons of the motor cortex during postural corrections. *J. Neurosci.*, 23(21): 7844-7853, 2003.

b. Karayannidou A, Deliagina TG, Tamarova ZA, Sirota MG, Zelenin PV, Orlovsky GN, Beloozerova IN. Influences of sensory input from the limbs on feline corticospinal neurons during postural responses. *J. Physiol. (L.)*, 586(Pt 1): 247-263, 2008.

c. Zelenin PV, Beloozerova IN, Sirota MG, Orlovsky GN, Deliagin`a TG. Activity of red nucleus neurons in the cat during postural corrections. *J. Neurosci.*, 30(43): 14533-14542, 2010.

d. Farrell BJ, Bulgakova MA, Beloozerova IN, Sirota MG, Prilutsky BI. Body stability and muscle and motor cortex activity during walking with wide stance. *J. Neurophysiol.*, 112(3): 504-524, 2014.

- We **have recently reviewed** a part of results on this topic in: Deliagina, Beloozerova, Orlovky, Zelenin. Contribution of supraspinal systems to generation of automatic postural responses. *Front Integr Neurosci.,* 8:76, 2014.